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# Towards a Theory Linking Forecasting and Decision Making

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## Abstract

This paper describes a theory linking forecasting practices and decision making. The theory begins with arguments drawn from microeconomic theory to make the case that concave criteria characterize many important decisions. The theory then draws on the decision literature to identify the two general categories of decision making errors; namely, bias and consistency. Through mathematical arguments and empirical research, it is shown that both bias and consistency have an impact on decision making -- but that consistency has the greater impact. The link between forecasting and decision making is based on using the forecasting process to improve consistency in decision making.

In industry, forecasting plays a crucial role in supporting decision making. Forecasters scan and characterize the environment; they try to understand what has happened and predict what will happen in the future. Their work has an important function -- to help decision makers make better decisions. In the literature, much attention is given to improving forecasting practices (including tools and techniques). However, little attention is paid to the relationship between forecasting practices and the success of the forecasters' clients, the decision makers.

In this paper a theory is developed to link the forecasting and decision making literature. The theory aids forecasters in evaluating the impact of their practices on decision quality. In this way forecasters can more fully support the decision processes of their clients.

This paper begins by justifying concave criteria for decisions; the arguments are based on microeconomic theory. These arguments are important because the concave criteria allow the mathematical derivation and empirical support for the theory. With concave cost functions, it is shown that in realistic situations the consistency of decision making has more impact that biased decision making.

The theory proposed in this paper is that forecasting practices will influence primarily the consistency in decision making. Also the theory proposes that consistency of decision making has a greater economic impact than bias. It is important to note that such a theory would predict a stronger relationship between forecasting practices and consistency of decision making that between forecasting practices and performance. The latter results because forecasting practices and performance are mediated by the intermediate variable, consistency of decision making.

There is empirical evidence to support the relationship between consistent decision making and the good forecasting procedures:

1. Reducing the forecasting error (a good practice) increases consistency of rule use but does not reduce the bias (Moskowitz and Miller, 1975).

2. Providing longer range forecasts (another good practice) increases the consistency of rule use except in the high forecast error condition (Moskowitz and Miller, 1975).

3. The levels of variability in the demand to be fore-casted are directly related to consistency of rule use (Remus and Kottemann, 1988).

Forecasting practices are not the only variables that are linked to consistency. As is argued in the paper, consistency is also influenced by learning and other variables. These additional variables allow us to better link forecasting and decision making. The model used is adapted from Hogarth (1987) and Einhorn and Hogarth (1981) and focuses on the processes of information acquisition, information evaluation, and feedback.

Do good forecasting practices help to reduce the decision variance and thereby improve performance? The answer this paper gives is definitely yes. However as Huber (1983) pointed out, it is unrealistic to expect any variable to have a great effect on decision making because there are so many other variables that also impact decision making. This argument also explains why good forecasting practices may not be perceived as having a great impact. Namely, their impact may not be noticed given all the variance created by the other variables.

There are interesting hypotheses that can be tested based on the theory. For example: Updates should improve decision making performance whenever the forecast error can be reduced by making the updates. What is the optimal schedule to improve consistency and performance in various forecasting environments? Providing confidence intervals rather than point estimates should impact consistency and performance. Will it increase or decrease the consistency and performance? Tightening confidence intervals through better statistical methods should improve decision making performance. Will it?

(a much longer version of this paper with many more references is available from the author)

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